



Navy Joining Center

A MANTECH CENTER OF EXCELLENCE

Operated by **EWI**

NJC Provides High Productivity Welding Technology for Next Generation Surface Combatant

The Navy Joining Center is participating with shipbuilders and other Navy MANTECH Centers of Excellence (COE) in several technology development projects for the U.S. Navy's next generation multi-role surface combatant – DD(X). One such project that has just been completed addressed a design concept that includes a number of large structures fabricated from thick section, high strength steel.

Construction of the DD(X) with high-strength steel structures requires welds that are of the highest integrity. Fabrication of these structures to meet design requirements was previously limited to manual welding practices and procedures. Welders were required to deposit many layers of weld metal while working in tight spaces as the base material is preheated to minimize risks of hydrogen cracking. Use of manual welding procedures for these structures required thousands of production man-hours per ship. It was determined from manufacturing cost estimates that the expense to fabricate these structures will be excessively high and production cycle times very long without significant improvements in manufacturing technology to replace the manual welding procedures.

This ManTech project was performed to meet the need for improved welding technology to reduce the construction cost and enhance the survivability of the DD(X) multi-mission destroyer. As such, it was necessary to optimize the deposition rate, increase the allowable heat input limits, decrease the joint volume, mechanize or automate the process, and utilize filler material systems with reduced cracking sensitivity.

The project evaluated alternative welding processes and procedures to replace the baseline manual gas metal arc welding approach. These alternatives included submerged arc and flux cored arc welding procedures to increase weld deposition rates and mechanized welding procedures to cut manual labor content. Weld joint designs were reconfigured to reduce the angles of weld grooves and thereby reduce the volume of weld metal



that must be deposited. The procedures were modeled through computer simulations and optimized for minimum distortion. The fabrication of several full scale test modules applied these developments to produce more than 50 percent of the welds with mechanized procedures. The combination of mechanization and reduced joint volume contributed to a 25 percent reduction in welding labor hours and a 15 percent increase in first-time weld acceptance.

The newly developed mechanized welding procedures and joint configuration have been successfully transferred to Northrop Grumman Ship Systems (NGSS) and Bath Iron Works (BIW). Both shipyards have been trained in the use of these procedures and have completed welding qualifications. NGSS used this technology to fabricate a full scale PVLS test module that successfully passed a Maximum Credible Detonation Event (MCDE) explosion test. The new weld joint configuration and welding procedures are the new baseline manufacturing process for the PVLS. These developments also are applicable the fabrication of other thick-section high-strength steel ship structures.

For More information please contact Larry Brown at (614) 688-5080, email larry_brown@ewi.org.

NJC at DMC 2005

Visit the NJC at the Defense Manufacturing Conference (DMC 2005) "Manufacturing in the Changing DoD Environment" to be held on November 28-December 1, 2005 at the Orlando World Center Marriott, Orlando FL. NJC will be located at booth #316. Information on NJC projects will be given in presentation sessions as well as demonstration of virtual reality welder training in the booth.

For additional information on the conference visit the DMC website at www.dmc.utcdayton.com.



The Navy Joining Center
1250 Arthur E. Adams Dr.
Columbus, Ohio 43221-3585
Phone: (614) 688-5010
FAX: (614) 688-5001
E-mail: NJC@ewi.org
Website: <http://www.ewi.org>
Contact: Larry Brown